

CLAIMS:

1. A process for germinating somatic embryos having a period of somatic embryo germination, said process comprising the steps of:
  - (a) placing a somatic embryo on or within a three-phase substrate, said phases comprising solid, liquid and gas phases,
  - (b) placing said substrate containing a somatic embryo into an environmentally-controlled plant-growing environment in which at least one environmental factor may be controlled and manipulated,
  - (c) manipulating said at least one factor to enable and facilitate germination of the somatic embryo, and
  - (d) applying water and/or nutrient solutions at regular intervals during said period of somatic embryo germination to the surface of the substrate in the form of microdroplets, for a period of time such that somatic embryo imbibition, germination, growth and development occur.
2. The process of claim 1 wherein said environmentally-controlled plant environment is non-sterile.
3. The process of claim 1 wherein said three-phase substrate is non-sterile.
4. The process of claim 1 wherein said somatic embryo placed on or within said substrate is a naked embryo.
5. The process of claim 1 wherein said at least one environmental factor of said controlled environment is selected from the group consisting of a moisture level within said three-phase substrate, atmospheric humidity, temperature, nutrients, ambient light intensity and diurnal photoperiod.
6. The process of claim 5 wherein said moisture level within said three-phase substrate is maintained in a range of 60-85% during the period of somatic embryo germination.

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~~7~~ The process of claim ~~6~~ wherein said moisture level is maintained in a range of 65-75%.

8. The process of claim 5 wherein said atmospheric humidity is maintained in the range of 75-100% during the period of somatic embryo germination.

5 9. The process of claim 8 wherein said atmospheric humidity is maintained within a range of 85-95%.

Sub A2  
10. The process of claim 5 wherein the temperature is maintained within a range of 15-37°C during the period of somatic embryo germination.

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10 ~~11~~ The process of claim ~~10~~ wherein the temperature is maintained within a range of 20-30°C.

Sub C2  
12. The process of claim 1 wherein the nutrients are applied at intervals within a range of 1 minute to 24 hrs.

13. The process of claim 1 where in the nutrients are applied at intervals within the range of 1 to 7 days.

15 14. The process of claim 1 where in the nutrients are applied for a period of time ranging from 3 to 8 weeks.

~~15~~ The process according to claim 1 wherein the somatic embryo is obtained from an angiosperm species.

20 ~~16~~ The process according to claim 1 wherein the somatic embryo is obtained from a gymnosperm species.

Sub B2  
17. The process according to claim 1 wherein the somatic embryo is a somatic embryo which has been previously desiccated to a final moisture content in the range of 5 - 75%.

~~Sub A4~~ 18. The process according to claim 1 wherein the solid phase of the three-phase substrate is selected from the group consisting of peat, sawdust, bark chips, wood chips, compost, moss, perlite, vermiculite, pumice, grit, sand, soil, cellulosic fibres of plant origin, extruded foams, extruded fibres, and chemically expanded foams.

Sub 5 B3 19. The process according to claim 1 wherein the solid phase of the three-phase substrate is a mixture of substrates selected from the group consisting of peat, sawdust, bark chips, wood chips, compost, moss, perlite, vermiculite, pumice, grit, sand, soil, cellulosic fibres of plant origin, extruded foams, extruded fibres, and chemically expanded foams.

10 20. The process according to claim 1, wherein the three-phase substrate contains a wetting agent.

~~Sub A~~ 21. The process according to claim 1, wherein the three-phase substrate is sterilized prior to receiving a somatic embryo.

~~Sub A4~~ 15 22. The process according to claim 1 wherein the moisture content of the three-phase substrate is adjusted with water to a range of 60-85% prior to receiving a somatic embryo.

23. The process according to claim 1 wherein the moisture content of the three-phase substrate is adjusted with a nutrient solution to a range of 60-85% prior to receiving a somatic embryo.

20 24. The process according to claim 1 wherein at least one fungicide to control plant pathogens is incorporated into the three-phase growth substrate.

25. The process according to claim 1 wherein at least one fungicide to control plant pathogens is applied in liquid form to the three-phase substrate.

26. The process according to claim 1 wherein at least one fungicide to control plant pathogens is applied in aerosol form to the three-phase substrate.
27. The process according to claim 1 wherein at least one insecticide to control plant pests is incorporated into the three-phase growth substrate.
- 5 28. The process according to claim 1 wherein at least one insecticide to control plant pests is applied in liquid form to the three-phase substrate.
29. The process according to claim 1 wherein at least one insecticide to control plant pests is applied in aerosol form to the three-phase substrate.
- 10 30. The process according to claim 1 wherein the three-phase substrate is contained within a horticultural container.
- ~~23~~ 31. The process according to claim ~~30~~ wherein the horticultural container is a tray containing cells.
- ~~24~~ 32. The process according to claim ~~31~~ wherein the tray is a miniplug tray.
- ~~25~~ 33. The process according to claim ~~30~~ wherein the horticultural container is a pot.
- 15 34. The process according to claim 1 wherein the somatic embryo placed on or within the three-phase substrate, is covered with a material selected from the group consisting of peat, sawdust, bark chips, wood chips, compost, moss, perlite, vermiculite, pumice, grit, sand, soil, cellulose fibres of plant origin, extruded foams, extruded fibres, and chemically expanded foams.
- 20 35. The process according to claim 1 wherein the somatic embryo is placed on or within the three-phase substrate with seeding equipment.
- ~~26~~ 36. The process according to claim ~~35~~ wherein the seeding equipment is a vacuum drum seeder.

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~~27~~ The process according to claim ~~25~~<sup>27</sup> wherein the seeding equipment is a needle jet seeder.

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~~28~~ The process according to claim ~~25~~<sup>27</sup> wherein the seeding equipment is a fluid drill seeder.

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~~Sub~~  
~~29~~ The process according to claim 1 wherein the microdroplets of water and nutrients applied to the surface of the three-phase substrate containing the somatic embryo, are delivered through a process selected from the group consisting of misting, fogging, and humidification.

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~~40~~ The process according to claim 39 wherein the nutrients applied as microdroplets to the surface of the three-phase substrate are selected from the group consisting of sugars, inorganic minerals, micronutrients, amino acids, vitamins, and plant growth regulators.

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~~Sub~~  
~~B6~~ 41. The process according to claim 39 wherein the sugars are selected from the group consisting of monosaccharides and polysaccharides.

42. The process according to claim 39 wherein the sugars are selected from the group consisting of glucose, fructose, mannose, maltose, and sucrose.

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43. The process according to claim 1 wherein only water is applied as microdroplets to the surface of the three-phase substrate for a period of 18-36 hours after placing the somatic embryo on or within the surface of the three-phase substrate, after which time, nutrient solutions are also applied as microdroplets.

~~A~~  
~~44. Germinated somatic embryos produced by the process of claim 1.~~

~~Sub~~  
~~C3~~ 45. A process of growing a somatic embryo into a seedling, which comprises maintaining a somatic embryo germinated according to the process of claim 1 in a three-phase

substrate, and growing said germinated embryo to develop the germinated embryo into a seedling.

46. The process of claim 45 wherein, as said seedling develops, a nutrient solution is applied at regular intervals to a surface of the substrate in the form of microdroplets.

5 36 47. The process of claim 35 wherein a volume of nutrient solution applied after said embryo has become autotrophic is less than a volume applied before said embryo has become autotrophic.

Sub A9 48. The process of claim 45 wherein no further nutrient solution is applied as microdroplets to said embryo after said embryo has become autotrophic.

10 49. The process of claim 46 wherein said embryos become autotrophic within a period of time in the range of 3 to 8 weeks.

50. A somatic seedling produced from a somatic embryo germinated by the process of claim 45.

51. The somatic seedling of claim 50 produced from an angiosperm somatic embryo.

15 52. The somatic seedling of claim 50 produced from a gymnosperm somatic embryo.

Sub C4 53. A process of germinating somatic embryos, which comprises:

(a) placing a somatic plant embryo on or within a non-sterile three-phase substrate, the phases comprising solid, liquid and gas phases,

(b) placing the substrate containing the somatic embryo into an environmentally-controlled plant-growing environment in which at least one environmental factor may be controlled and manipulated,

(c) manipulating at least one factor to enable and facilitate germination of the somatic embryo, and

(d) applying water and/or a nutrient solution at regular intervals during the period of somatic embryo germination for a period of time such that somatic embryo imbibition, germination, growth and development occur.

54. A process according to claim 53 wherein the environmentally-controlled plant environment is non-sterile.

55. A process according to claim 53 wherein the embryo placed on or within the three-phase substrate is a naked embryo.

56. A process according to claim 53 wherein the water and/or nutrient solution is applied in the form of microdroplets.

57. A process for germinating somatic embryos having a period of somatic embryo germination, said process comprising the steps of:

(a) placing a somatic embryo on or within a three-phase substrate, said phases comprising solid, liquid and gas phases,

(b) placing said substrate containing a somatic embryo into an environmentally-controlled plant-growing environment in which at least one environmental factor may be controlled and manipulated,

(c) manipulating said at least one factor to enable and facilitate germination of the somatic embryo, and

(d) applying water and/or nutrient solutions at regular intervals during said period of somatic embryo germination by drenching or irrigating the three-phase growing media, for a period of time such that somatic embryo imbibition, germination, growth and development occur.

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